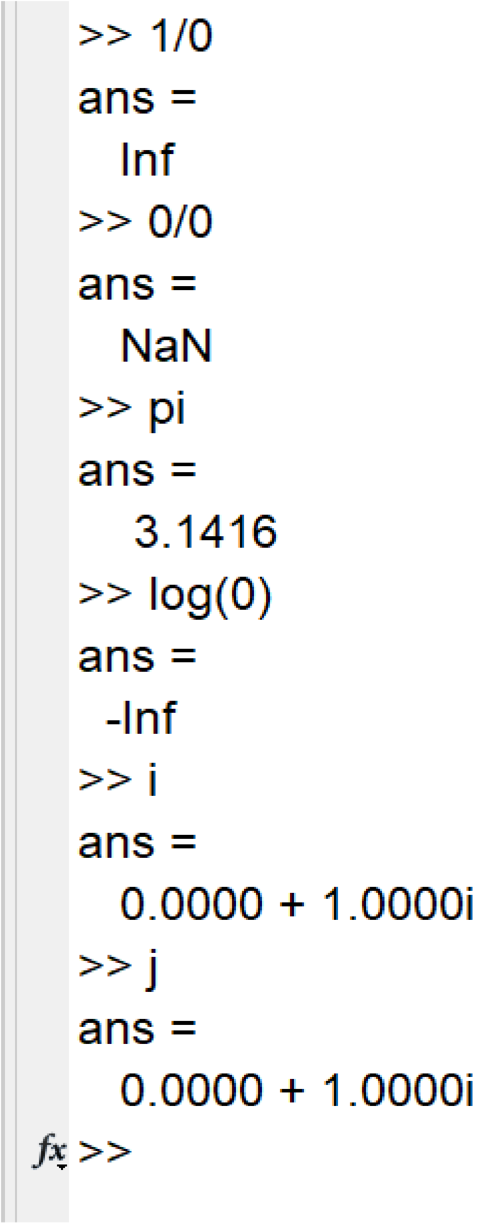
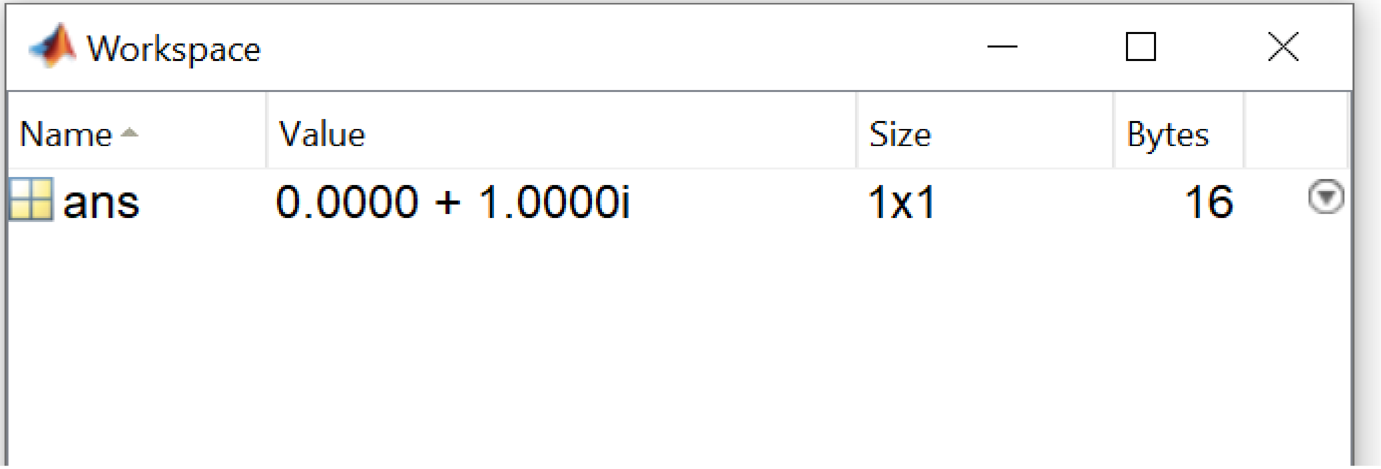
Functions /Operators

1. Parentheses ()
2. Transpose (.'), power (.^), complex conjugate transpose ('), matrix power (^)
3. unary minus (-), logical negation (~)
4. Multiplication (.*), right division (./), left division (.\),
   matrix multiplication (*), matrix right division (/),
   matrix left division (\)
1. Addition (+), subtraction (-)
2. Colon operator (:)
3. Less than (<), less than or equal to (<=), greater than (>), greater than or equal to (>=), equal to (==), not equal to (~=)
4. Element-wise AND (&)
5. Element-wise OR (|)

Defined variables



```
>> 1/0
ans =
   Inf
>> 0/0
ans =
   NaN
>> pi
ans =
    3.1416
>> log(0)
ans =
  -Inf
>> i
ans =
   0.0000 + 1.0000i
>> j
ans =
   0.0000 + 1.0000i
>>
```



Name	Value	Size	Bytes
ans	0.0000 + 1.0000i	1x1	16

Numeric Types

MATLAB represents floating-point numbers in either double-precision or single-precision format. The default is double precision.

name	**byte**	**min**	**max**
Double	8	-1.79769e+308	1.79769e+308
Single	4	-3.4 x 10^{38}	3.4 x 10^{38}

Numeric Types

name	**byte**	**Min**	**max**
uint8	1	0	2^{8}-1
uint16	2	0	2^{16}-1
uint32	4	0	2^{32}-1
uint64	8	0	2^{64}-1
int8	1	-2^{7}	2^{7}-1
int16	2	-2^{15}	2^{15}-1
int32	4	-2^{31}	2^{31}-1
int64	8	-2^{63}	2^{63}-1

Elementary Functions

Elementary Functions
Trigonometric functions

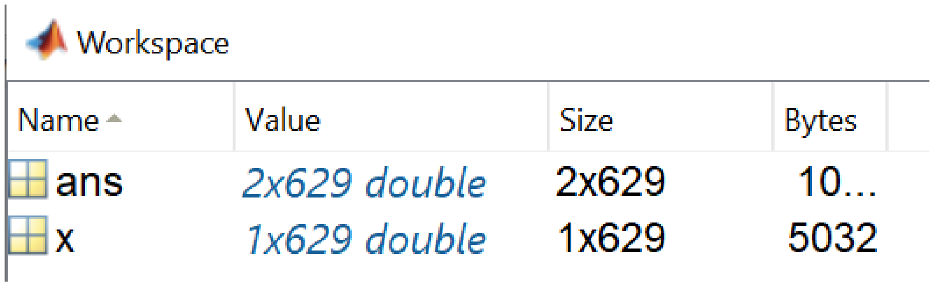
1) sin , returns the sine of argument in radians,

   Y=sin(X),

   returns real values in the interval [-1, 1].

- Example

```
>>x = -pi : 0.01 : pi;
>>[x ; sin(x)]
```



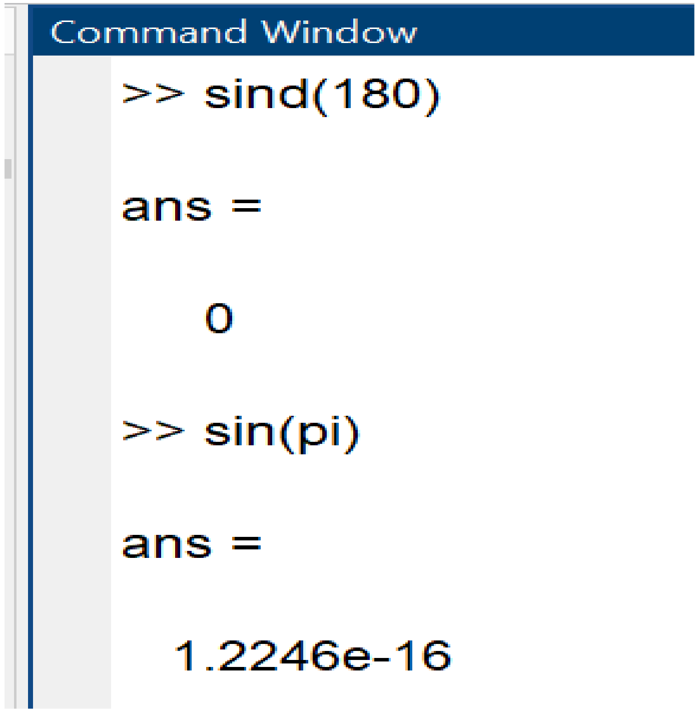
Workspace

Name	Value	Size	Bytes
ans	2x629 double	2x629	10...
x	1x629 double	1x629	5032

Elementary Functions
Trigonometric functions

2) sind , returns the sine of argument in degrees,

Example :



```
>> sind(180)

ans =

     0

>> sin(pi)

ans =

   1.2246e-16
```

Elementary Functions
Trigonometric functions

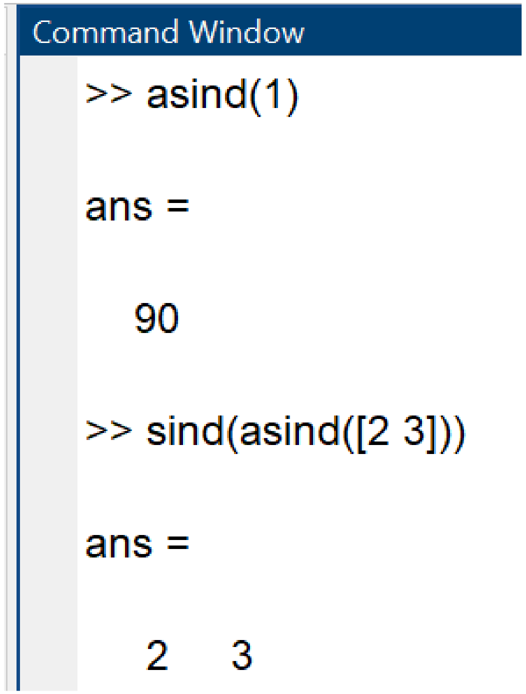
3) asind , returns the Inverse sine (sin-^{1}) of the elements of X in degrees.

real values of X are in the interval [-1, 1],

asind(X) returns values in

the interval [-90, 90]

Examples:



```
>> asind(1)

ans =

    90

>> sind(asind([2 3]))

ans =

     2     3
```

Elementary Functions
Trigonometric functions

4) same for cos, tan, cot

acos, cosd, acosd, ….

5) deg2rad , Convert angles from degrees to radians.

```
>>R = deg2rad(90)
    R = 1.5708
```

6) rad2deg , Convert angles from radians to degrees.

```
>>D = rad2deg(pi)
    D = 180
```

Elementary Functions exponential functions

- exp , returns the exponential e^x for each element in array X.

Example

Calculate the exponential of 1, which is Euler's number, e.

```
>>exp(1)
      ans = 2.7183
```

Elementary Functions
exponential functions

- log returns the natural logarithm ln(x) of each element in array X.

```
>> y=log(exp(1))
    ans =    1
```

- reallog returns the natural logarithm ln(x) of each element in array X .
  Array X must contain only nonnegative real numbers.

- The size of the result is the same as the size of X.

Elementary Functions
exponential functions

- Log10 returns the common logarithm of each element in array X.

For real values of X in the interval (0, Inf), log10 returns real values in the interval (-Inf ,Inf).

```
>>log10(10)
    ans = 1
```

The result is 1 since 10^1 =10

```
>>log10(100)
    ans = 2
```

The result is 2 since 10^2=100

```
>>log10(0)
    ans = -Inf
```

The result is -Inf since 10 −∞=0

```
>>log10(0)
    ans = -Inf
```

The result is -Inf since 10−∞=0

Elementary Functions
exponential functions

- Realsqrt(X) , returns the square root of each element of array X.

  X numbers should be greater than or equal to zero, instead realsqrt returns error messages.

- sqrt , returns the square root of each element of the array X.

  For the elements of X that are negative or complex, sqrt(X) produces complex results.

- The size of the answer is the same as the size of X.

Elementary Functions
exponential functions

- nthroot , returns the real nth root of the elements of X.
- Examples :

```
>> nthroot(8,3)
        ans=2
>>N = [5 3 -1];
>>Y = nthroot(-8,N)
        Y =
          -1.5157   -2.0000   -0.1250
```

Using nthroot to calculate several real roots of -8 : The result is a vector of the same size as N.

- Both X and N must be real scalars or arrays of the same size. If an element in X is negative, then the corresponding element in N must be an odd integer.

Elementary Functions
Complex functions

- z = complex(a,b) Construct complex output data, z, of real and imaginary parts, using two real inputs,

- The complex function provides a useful substitute for expressions, such as a + 1i*b or a + 1j*b, when :
  - b is all zeros
  - i and j are already used

- Examples

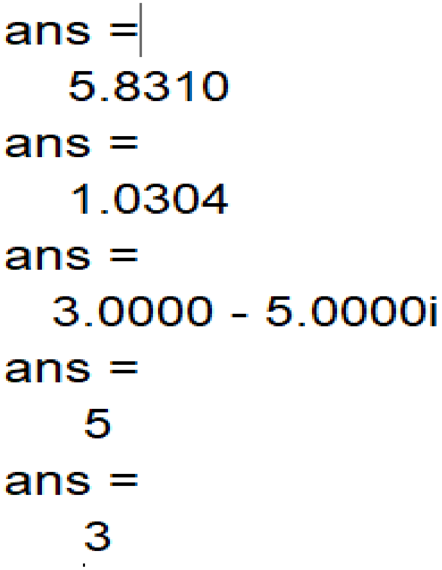
```
>>z = complex(3)
Z=   3.0000 + 0.0000i


>>i=2,    Z=3+i,    Z=complex (3,1)
```

Elementary Functions
Complex functions

>>Z= complex(3,5)

- abs (Z) - Absolute value and complex magnitude
- angle (Z) - Phase angle.
- conj(Z) - Complex conjugate.
- imag (Z) - Complex imaginary part.
- real(Z) - Complex real part.



```
ans =
    5.8310
ans =
    1.0304
ans =
   3.0000 - 5.0000i
ans =
     5
ans =
     3
```